AASHTO T 84 – SPECIFIC GRAVITY AND ABSORPTION
OF FINE AGGREGATE

Conduct this procedure according to AASHTO T 84, NDDOT Modified.

The standard test procedure uses a 500 mL pycnometer (flask) while the NDDOT uses a 1000 mL pycnometer. The standard test procedure uses a 1000 g sample which is soaked 15 to 19 hours. The NDDOT modification is to use an 1100 g sample which is soaked for 17±1 hours.

The standard test procedure specifies the aggregate is in a surface dry condition when the aggregate slumps slightly when the mold is removed. The NDDOT modification specifies that the aggregate is in a surface dry condition when the mold is removed and 25% to 75% of the top diameter of the surface slumps.

A glass cover plate is used with the pycnometer.

The standard test procedure specifies that the sample in the pycnometer may be immersed in circulating water to adjust its temperature to 73.4°±3°F (23±1.7°C). NDDOT requires placement of the sample in the pycnometer in a water bath for 60±15 minutes.

The standard procedure specifies that the calculated specific gravity be recorded to the hundredth and the calculated absorption to the tenth of a percent. The NDDOT modification is to record the calculated specific gravity to the thousandths and the calculated absorption to the hundredth of a percent.

Consult the current edition of AASHTO for procedure in its entirety and equipment specification details.

SCOPE

This test method covers the determination of the bulk specific gravity and the apparent specific gravity on the basis of mass of saturated surface dry aggregate and absorption of a fine aggregate sample. Fine aggregate is defined as material that passes the No. 4 sieve.

REFERENCED DOCUMENTS

AASHTO T 2, Sampling of Aggregates
AASHTO T 248, Reducing Samples of Aggregate to Testing Size
AASHTO T 255, Total Evaporable Moisture Content of Aggregate by Drying

APPARATUS

Balance
Pycnometer (flask) and glass cover plate
Metal mold in the form of a frustum of a cone
Metal tamper with a mass of 340±15 g and tamping face 25±3 mm in diameter
Pan
Spoon
Small fan
Temperature-controlled water bath
Sieves: No. 4 (4.75 m)
Oven

TEST SPECIMEN

Obtain sample according to T 2. Thoroughly mix and reduce to testing size according to T 248.

Test specimen shall be a representative sample of approximately 1100 g of material passing the No. 4 sieve.

FLASK CALIBRATION

Calibrate the flask by determining the weight of the flask full of distilled water at 73.4 ± 3°F (23 ± 1.7°C). Overfill the flask so the water is convexed above the brim. Very carefully slide a cover plate over the brim of the flask. The flask should be free of any air bubbles. Wipe any moisture on the outside of the flask and weigh the flask, water, and cover plate. Record this weight as weight of flask, cover plate, and water. Empty the flask and repeat the calibration. Repeated weights should agree within 0.2 g.

PROCEDURE

Record all information on SFN 2199. Weights are recorded to the nearest 0.1 g.

Dry the sample according to T 255, at a temperature of 230 ± 9°F (110 ± 5°C). Allow the sample to cool to a comfortable handling temperature.

Place the sample in a pan, cover with distilled water, and soak for 17±1 hours. After the soak period carefully remove excess water. Take care to avoid loss of any fines.

Spread the entire sample on a flat, non-absorbent surface and expose it to a gently moving current of warm air produced by the fan set at a low speed. Stir the sample frequently to obtain uniform drying.

The purpose of the slow, uniform drying is to bring the fines to a saturated surface dry condition. In this condition moisture fills the pores of each particle while the surface of the particle is dry. If non-uniform drying is allowed, the results may be in error because over-dried portions of the aggregate will not be saturated. Continue the process until the

sample approaches a free flowing condition. It is intended the first trial of the cone test be made with some surface water in the sample.

Place the mold (large diameter down) on a smooth, level, firm, non-absorbent surface and fill with the partially dried material. Fill the cone to overflowing. Heap additional material above the top of the mold by holding the mold with cupped fingers and pouring material on top of the mold. Tamp the surface of the material in the mold 25 times with the tamper. Each drop of the tamper should start 0.2" (5 mm) above the top of the fine aggregate. Allow the tamper to fall freely during each drop. Adjust the starting height after each drop. Distribute the drop evenly over the entire surface.

Remove the material spilled around the mold and slowly lift the mold vertically.

If surface moisture is still present in the sample, the fine aggregate will retain the molded shape and additional drying is required. If the sample slumps on the first try, the material has dried past the saturated surface dry state. It is possible to get the fine aggregate too dry on the first attempt, but the test can be saved by adding a few mL of water to the sample, mixing it, covering, and allowing the sample to set for 30 minutes before rechecking. Only one recheck is permitted.

Test the tamped fine aggregate at frequent intervals until 25 to 75% of the top diameter of the cone slumps. At this point the material has reached the saturated surface dry condition. Immediately weigh out exactly 500 g of the saturated surface dry material for introduction into the flask.

Partially fill the flask with distilled water. Immediately introduce 500 g of the saturated surface dry material into the flask. Add distilled water until the neck of the flask is partially filled. Roll and agitate the flask to eliminate the air bubbles. Periodically stop agitating and rolling the flask to allow the air bubbles to rise to the top and be eliminated. Continue the agitating, rolling, and bubble elimination procedures until all the bubbles are eliminated. It normally takes about 15 to 20 minutes to eliminate the air bubbles.

Place the flask in a water bath at 73.4 ± 3°F (23 ± 1.7°C) for 60±15 minutes. To eliminate air bubbles, periodically remove the flask from the water bath, gently agitate it, and place it back in the water bath. All the air bubbles must be removed. This requires good technique and judgment. If the air bubbles are not completely removed, the results will be erratic. After the flask has been in the water bath for the specified time, remove.

After removal from the water bath, add distilled water to bring the level to the top of the flask. Overfill the flask so that the water is convexed over the brim and slide the glass cover plate along the brim. The flask should be free of any air bubbles. Wipe any moisture from the flask and weigh the flask, cover plate, sample and water. Record this weight as weight of flask, cover plate, sample, and water to top of flask.

Carefully pour the sample and the water into a tarred pan. Rinse the residue from the flask into the pan with a squeeze bottle. Oven dry the sample according to T 255 at a temperature of 230 ± 9°F (110 ± 5°C). Cover and allow the sample to cool to room temperature for 30 to 90 minutes. Weigh and record as weight of oven dry sample.

CALCULATIONS AND REPORTING

To calculate bulk specific gravity, divide the dry weight in air by the results of the flask filled with water plus weight of the saturated surface dry sample minus the weight of the flask with sample and water to top of flask. The equation is as follows:

Bulk Specific Gravity = A/(B + S - C)

A = weight of oven dry sample
B = weight of flask and cover plate filled with water
C = weight of flask, cover, sample and water to top of flask
S = weight of saturated surface dry sample (500 g)

Report the result to the 0.001.

To calculate bulk specific gravity (Saturated Surface Dry), divide the weight of saturated surface dry sample by the results of the flask filled with water plus weight of the saturated surface dry sample minus the weight of the flask with sample and water to top of flask. The equation is as follows:

Bulk Specific Gravity (Saturated Surface Dry) = S/(B + S - C)

Report the result to the 0.001.

To calculate apparent specific gravity, divide the weight of oven dry sample in air by the results of the flask filled with water plus weight of oven dry sample in air minus the weight of the flask with sample and water to top of flask. The equation is as follows:

Apparent Specific Gravity = A/(B+A-C)

Report the result to the 0.001.

To calculate absorption, subtract the weight of oven dry sample in air from the weight of saturated surface dry sample and divide the result by the weight of oven dry sample in air. Multiply this result by 100. The equation is as follows:

Absorption = [(S-A)/A] x 100

Report the result to the nearest 0.01%.

NOTES

Dipping the tip of a paper towel into the pycnometer has been found to be useful in dispersing the foam that sometimes builds up when eliminating the air bubbles.

CALIBRATION

A calibration check of the equipment should be performed annually as a minimum, or whenever damage or repair occurs.